CLAIMS

1. A polar modulator, comprising:

a power amplification section;

a phase modulation section for generating a first modulated signal including phase information;

an amplitude signal control section for generating a second modulated signal including amplitude information;

a waveform shaping section for, when an amplitude of the second modulated signal is larger than a predetermined regulated value, generating a waveform-shaped modulated signal obtained as a result of shaping a waveform of the second modulated signal, such that the amplitude of a portion of the second modulated signal which exceeds the predetermined regulated value becomes equal to or smaller than the predetermined regulated value;

a voltage control section for outputting a supply voltage; and

an amplitude modulated voltage supply section for amplifying the waveform-shaped modulated signal using a transistor based on the supply voltage which is output from the voltage control section and for supplying the amplified signal to the power amplification section as an amplitude modulated voltage;

wherein:

the power amplification section amplifies the first modulated signal based on the amplitude modulated voltage, and thus outputs a third modulated signal obtained as a result of

modulating an amplitude of the first modulated signal; and

the waveform shaping section adjusts the predetermined regulated value in accordance with a factor for changing a distorted power generated by the power amplification section, such that an ACP generated in the power amplification section becomes equal to or smaller than a first predetermined value, or such that a power at a receiving band becomes equal to or smaller than a second predetermined value.

2. A polar modulator according to claim 1, wherein:

a power value of the first modulated signal is a factor for changing the distorted power generated by the power amplification section; and

the waveform shaping section adjusts the predetermined regulated value in accordance with the power value of the first modulated signal.

3. A polar modulator according to claim 1, wherein:

an amplitude value of the second modulated signal is a factor for changing the distorted power generated by the power amplification section; and

the waveform shaping section adjusts the predetermined regulated value in accordance with the amplitude value of the second modulated signal.

4. A polar modulator according to claim 1, wherein:

a combination of a gain shown in a control channel and a gain shown in a data channel is a factor for changing a peak to

average power ratio (PAPR); and

the waveform shaping section adjusts the predetermined regulated value in accordance with the combination of the gain shown in the control channel and the gain shown in the data channel.

5. A polar modulator according to claim 1, wherein:

a number of sub carriers to be used is a factor for changing a peak to average power ratio (PAPR); and

the waveform shaping section changes the number of the sub carriers to be used or a modulation system to be used.

6. A polar modulator according to claim 1, wherein:

the polar modulator is capable of outputting a signal using any of a plurality of modulation systems;

a modulation system to be used is a factor for changing a peak to average power ratio (PAPR); and

the waveform shaping section adjusts the predetermined regulated value in accordance with the modulation system to be used.

7. A polar modulator according to claim 1, further comprising a memory section for storing the predetermined regulated value which is set by the waveform shaping section;

wherein the waveform shaping section reads the predetermined regulated value from the memory section and thus adjusts the predetermined regulated value.

8. A polar modulator according to claim 7, wherein the memory section has step-by-step regulated values stored therein in

correspondence with a plurality of different output powers from the power amplification section.

9. A polar modulator according to claim 1, wherein:

the voltage control section includes a plurality of DC power supplies capable of outputting a plurality of different supply voltages from one another;

the amplitude modulated voltage supply section includes a plurality of series regulators respectively provided in correspondence with the plurality of DC power supplies, each of the plurality of series regulators being for amplifying the waveform-shaped modulated signal using the transistor based on the corresponding supply voltage and for supplying the amplified signal to the power amplification section as the amplitude modulated voltage; and

the polar modulator further comprises a switch section for inputting the waveform-shaped modulated signal generated by the waveform shaping section to any one of the plurality of series regulators.

10. A polar modulator according to claim 9, wherein:

the polar modulator is capable of outputting a signal using any of a plurality of modulation systems;

the modulation system to be used is a factor for changing the distorted power generated by the power amplification section;

the waveform shaping section adjusts the predetermined regulated value in accordance with the modulation system to be

used; and

the switching section selects the series regulator, to which the waveform-shaped modulated signal is to be input, in accordance with the modulation system to be used.

11. A polar modulator, comprising:

a power amplification section;

a phase modulation section for generating a first modulated signal including phase information;

an amplitude signal control section for generating a second modulated signal including amplitude information;

a voltage control section for outputting a supply voltage; and

an amplitude modulated voltage supply section for amplifying the second modulated signal using a transistor based on the supply voltage which is output from the voltage control section and for supplying the amplified signal to the power amplification section as an amplitude modulated voltage;

wherein:

the power amplification section amplifies the first modulated signal based on the amplitude modulated voltage, and thus outputs a third modulated signal obtained as a result of modulating an amplitude of the first modulated signal; and

the voltage control section supplies a voltage, obtained based on a maximum value of the amplitude modulated voltage which is output from the transistor, to the amplitude modulated voltage

supply section as the supply voltage.

12. A polar modulator according to claim 11, wherein:

the voltage control section is a switching regulator;

the switching regulator is provided with a voltage from a battery; and

the voltage control section supplies a voltage, which is higher than a voltage obtained as a result of adding the maximum value of the amplitude modulated voltage and a constant voltage determined based on a saturation voltage of the transistor and which is lower than the voltage provided from the battery, to the amplitude modulated voltage supply section as the supply voltage.

13. A polar modulator according to claim 11, further comprising a voltage measuring section for detecting the maximum value of the amplitude modulated voltage which is output from the amplitude modulated voltage supply section;

wherein the voltage control section supplies the supply voltage, obtained based on the maximum value of the amplitude modulated voltage detected by the voltage measuring section, to the amplitude modulated voltage supply section.

14. A polar modulator according to claim 11, wherein the voltage control section obtains the maximum value of the amplitude modulated voltage based on the amplitude information, and supplies a voltage, obtained based on the obtained maximum value, to the amplitude modulated voltage supply section as the supply voltage.

15. A polar modulator according to claim 11, wherein the

voltage control section supplies a voltage, obtained as a result of adding the maximum value of the amplitude modulated voltage and a constant voltage determined based on the saturation voltage of the transistor, to the amplitude modulated voltage supply section as the supply voltage.

16. A polar modulator according to claim 11, further comprising a waveform shaping section for, when an amplitude of the second modulated signal is larger than a predetermined regulated value, generating a waveform-shaped modulated signal obtained as a result of shaping a waveform of the second modulated signal, such that the amplitude of a portion of the second modulated signal which exceeds the predetermined regulated value becomes equal to or smaller than the predetermined regulated value;

wherein the amplitude modulated voltage supply section amplifies the waveform-shaped modulated signal, instead of the second modulated signal, using the transistor, and supplies the amplified signal to the power amplification section as the amplitude modulated voltage.

17. A polar modulator according to claim 16, wherein the voltage control section supplies a voltage, obtained as a result of adding the predetermined regulated value and a constant voltage determined based on the saturation voltage of the transistor, to the amplitude modulated voltage supply section as the supply voltage.

18. A polar modulator according to claim 16, wherein the

waveform shaping section adjusts the predetermined regulated value in accordance with a factor for changing a distorted power generated by the power amplification section, such that an ACP generated in the power amplification section becomes equal to or smaller than a first predetermined value, or such that a power at a receiving band becomes equal to or smaller than a second predetermined value.

19. A polar modulator according to claim 11, wherein:

the voltage control section includes a plurality of DC power supplies capable of outputting a plurality of different supply voltages from one another;

the amplitude modulated voltage supply section includes a plurality of series regulators respectively provided in correspondence with the plurality of DC power supplies, each of the plurality of series regulators being for amplifying the second modulated signal using the transistor based on the corresponding supply voltage and for supplying the amplified signal to the power amplification section as the amplitude modulated voltage;

the polar modulator further comprises a switch section for inputting the second modulated signal to any one of the plurality of series regulators; and

the voltage control section selects the DC power supply to be used based on the maximum value of the amplitude modulated voltage which is output from the transistor included in the series regulator to be used, and supplies a voltage, which is output from the DC power supply to be used, to the amplitude modulated voltage supply

section as the supply voltage.

20. A polar modulator according to claim 19, wherein:

the polar modulator is capable of outputting a signal using any of a plurality of modulation systems; and

the switch section selects the series regulator, to which the second modulated signal is to be input, in accordance with the modulation system to be used.

21. A polar modulator, comprising:

a power amplification section;

a phase modulation section for generating a first modulated signal including phase information;

an amplitude signal control section for generating a second modulated signal including amplitude information;

a voltage control section for outputting a supply voltage; and

an amplitude modulated voltage supply section for amplifying the second modulated signal using a transistor based on the supply voltage which is output from the voltage control section and for supplying the amplified signal to the power amplification section as an amplitude modulated voltage;

wherein:

the power amplification section amplifies the first modulated signal based on the amplitude modulated voltage, and thus outputs a third modulated signal obtained as a result of modulating an amplitude of the first modulated signal; and

the voltage control section supplies the supply voltage, at which the transistor is operated in a constant current region, to the amplitude modulated voltage supply section.

22. A polar modulator according to claim 21, wherein when the transistor is a bipolar transistor, the constant current region is a non-saturation region.

23. A polar modulator according to claim 21, wherein when the transistor is a MOS transistor, the constant current region is a saturation region.

24. A polar modulator according to claim 21, further comprising a waveform shaping section for, when an amplitude of the second modulated signal is larger than a predetermined regulated value, generating a waveform-shaped modulated signal obtained as a result of shaping a waveform of the second modulated signal, such that the amplitude of a portion of the second modulated signal which exceeds the predetermined regulated value becomes equal to or smaller than the predetermined regulated value;

wherein the amplitude modulated voltage supply section amplifies the waveform-shaped modulated signal, instead of the second modulated signal, using the transistor, and supplies the amplified signal to the power amplification section as the amplitude modulated voltage.

25. A polar modulator according to claim 24, wherein the voltage control section supplies a voltage, obtained as a result of adding the predetermined regulated value and a constant voltage

obtained based on a saturation voltage of the transistor, to the amplitude modulated voltage supply section as the supply voltage.

26. A polar modulator according to claim 24, wherein the waveform shaping section adjusts the predetermined regulated value in accordance with a factor for changing a distorted power generated by the power amplification section, such that an ACP generated in the power amplification section becomes equal to or smaller than a first predetermined value, or such that a power at a receiving band becomes equal to or smaller than a second predetermined value.

27. A polar modulator according to claim 21, wherein:

the voltage control section includes a plurality of DC power supplies capable of outputting a plurality of different supply voltages from one another;

the amplitude modulated voltage supply section includes a plurality of series regulators respectively provided in correspondence with the plurality of DC power supplies, each of the plurality of series regulators being for amplifying the second modulated signal using the transistor based on the corresponding supply voltage and for supplying the amplified signal to the power amplification section as the amplitude modulated voltage;

the polar modulator further comprises a switch section for inputting the second modulated signal to any one of the plurality of series regulators; and

the voltage control section selects the DC power supply to be used based on the maximum value of the amplitude modulated voltage

which is output from the transistor included in the series regulator to be used, and supplies a voltage, which is output from the DC power supply to be used, to the amplitude modulated voltage supply section as the supply voltage.

28. A polar modulator according to claim 27, wherein:

the polar modulator is capable of outputting a signal using any of a plurality of modulation systems; and

the switch section selects the series regulator, to which the second modulated signal is to be input, in accordance with the modulation system to be used.

29. A wireless communication apparatus using a battery as a power supply, comprising:

a baseband section for generating and processing a baseband signal;

a transmission section for converting the baseband signal generated by the baseband section into a transmission signal;

an antenna section for receiving a receiving signal;

a receiving section for converting the receiving signal into a baseband signal and inputting the baseband signal to the baseband section; and

a common section for transferring the transmission signal to the antenna section and transferring the receiving signal to the receiving section;

wherein:

the transmission section includes a polar modulator for

converting the baseband signal into the transmission signal; and

the polar modulator comprises:

a power amplification section;

a phase modulation section for generating a first modulated signal including phase information from the baseband signal;

an amplitude signal control section for generating a second modulated signal including amplitude information from the baseband signal;

a waveform shaping section for, when an amplitude of the second modulated signal is larger than a predetermined regulated value, generating a waveform-shaped modulated signal obtained as a result of shaping a waveform of the second modulated signal, such that the amplitude of a portion of the second modulated signal which exceeds the predetermined regulated value becomes equal to or smaller than the predetermined regulated value;

a voltage control section for outputting a supply voltage; and

an amplitude modulated voltage supply section for amplifying the waveform-shaped modulated signal using a transistor based on the supply voltage which is output from the voltage control section and for supplying the amplified signal to the power amplification section as an amplitude modulated voltage;

wherein:

the power amplification section amplifies the first modulated signal based on the amplitude modulated voltage, and

thus outputs a third modulated signal obtained as a result of modulating an amplitude of the first modulated signal; and

the waveform shaping section adjusts the predetermined regulated value in accordance with a factor for changing a distorted power generated by the power amplification section, such that an ACP generated in the power amplification section becomes equal to or smaller than a first predetermined value, or such that a power at a receiving band becomes equal to or smaller than a second predetermined value.

30. A wireless communication apparatus using a battery as a power supply, comprising:

a baseband section for generating and processing a baseband signal;

a transmission section for converting the baseband signal generated by the baseband section into a transmission signal;

an antenna section for receiving a receiving signal;

a receiving section for converting the receiving signal into a baseband signal and inputting the baseband signal to the baseband section; and

a common section for transferring the transmission signal to the antenna section and transferring the receiving signal to the receiving section;

wherein:

the transmission section includes a polar modulator for converting the baseband signal into the transmission signal; and

the polar modulator comprises:

a power amplification section;

a phase modulation section for generating a first modulated signal including phase information from the baseband signal;

an amplitude signal control section for generating a second modulated signal including amplitude information from the baseband signal;

a voltage control section for outputting a supply voltage; and

an amplitude modulated voltage supply section for amplifying the second modulated signal using a transistor based on the supply voltage which is output from the voltage control section and for supplying the amplified signal to the power amplification section as an amplitude modulated voltage;

wherein:

the power amplification section amplifies the first modulated signal based on the amplitude modulated voltage, and thus outputs a third modulated signal obtained as a result of modulating an amplitude of the first modulated signal; and

the voltage control section supplies a voltage, obtained based on a maximum value of the amplitude modulated voltage which is output from the transistor, to the amplitude modulated voltage supply section as the supply voltage.

31. A wireless communication apparatus using a battery as a power supply, comprising:

a baseband section for generating and processing a baseband signal;

a transmission section for converting the baseband signal generated by the baseband section into a transmission signal;

an antenna section for receiving a receiving signal;

a receiving section for converting the receiving signal into a baseband signal and inputting the baseband signal to the baseband section; and

a common section for transferring the transmission signal to the antenna section and transferring the receiving signal to the receiving section;

wherein:

the transmission section includes a polar modulator for converting the baseband signal into the transmission signal; and

the polar modulator comprises:

a power amplification section;

a phase modulation section for generating a first modulated signal including phase information from the baseband signal;

an amplitude signal control section for generating a second modulated signal including amplitude information from the baseband signal;

a voltage control section for outputting a supply voltage; and

an amplitude modulated voltage supply section for amplifying the second modulated signal using a transistor based on the supply

voltage which is output from the voltage control section and for supplying the amplified signal to the power amplification section as an amplitude modulated voltage;

wherein:

the power amplification section amplifies the first modulated signal based on the amplitude modulated voltage, and thus outputs a third modulated signal obtained as a result of modulating an amplitude of the first modulated signal; and

the voltage control section supplies the supply voltage, at which the transistor is operated in a constant current region, to the amplitude modulated voltage supply section.